Paul A. Mathew

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Experience

Lawrence Berkeley National Laboratory

Staff Scientist, Environmental Energy Technologies Division (March 2002 – present)

High Performance Laboratories: Technical Coordinator for Labs21 Environmental Performance Criteria ♦ Technical Lead for benchmarking process and tools for laboratory energy use ♦ Course instructor for lab design introductory course ♦ Initiated development of lab design manual for energy efficiency and environmental sustainabilty.

Federal Energy Management Program: Initiated project to use risk analysis methods to optimize investment in measurement and verification protocols for SuperESPCs.

Enron Energy Services

Manager, Energy Asset Management (August 2000 – December 2001)

Deal Pricing: Spearheaded development and use of statistical techniques and models to value large portfolios of energy efficiency projects ♦ Worked with engineering experts to develop probabilistic "curves" of energy savings and capital costs for pricing commercial and industrial energy efficiency projects ♦ Supervised curve development team ♦ Used curves in pricing over 10 deals, worth over $20 Million.

Business Process Development: Received "Power Player" management award for creating business processes and tools to support scaleable, portfolio-based pricing of energy efficiency projects ♦ Worked with sales and engineering groups to advocate, disseminate, and implement new business processes and tools for scaleable pricing.

Center for Building Performance Carnegie Mellon University

Research Scientist (May 1996 – July 2000)

Building Performance Research and Consulting: Served as a Principal Investigator on several research and consulting projects on energy efficient building design ♦ Collaborated with industry, government and consultants on development of "Intelligent Buildings"♦ Over 8 years experience using **DOE-2** for detailed energy analysis ♦ Performed ASHRAE 90.1 certification for energy efficiency ♦ Conducted occupancy evaluations and field diagnostics of indoor thermal, lighting and air quality.

Simulation Tools Development: Designed and implemented CAD-integrated simulation tool for collaborative building design and energy simulation ♦ Used case tools for developing object-oriented software systems.

Education and Training: Conducted professional seminars on high-performance building design ♦ Developed and taught graduate course in energy simulation ♦ Supervised graduate and undergraduate student projects.

Education

Ph.D. in Building Performance and Diagnostics. May 1996.
Carnegie Mellon University
Thesis: Integrated Energy Modeling for Computational Building Design Assistance

Master of Science in Building Performance and Diagnostics. December 1990.
Carnegie Mellon University

Selected Projects

Energy Services

Curve Database for Energy Asset Management (2000-2001)
Initiated, designed and supervised implementation of Enron EAM curve database - used to generate probabilistic curves using external and internal data sources. Used curves for pricing energy savings and capital costs of standardized projects in lighting, HVAC, compressed air, refrigeration, and motors in various commercial and industrial deals.

Enron EnVest Product for Office and Retail Customers (2001)
Worked with team of engineers, pricing managers and sales managers to develop packaged energy services product for office and retail customers. Product encapsulated standardized contract, projects scope, pricing, and delivery.

Building Performance Consulting

Soffer Tech Office (1998-2000)
Developed high-performance system alternatives for 65,000 sq.ft. speculative office building; Performed parametric DOE-2 energy simulations and ASHRAE 90.1 certification.

PNC Bank Operations Center (1998)
Performed quantitative and qualitative performance analysis to evaluate light-wells, atrium, enclosure glazing and shading for 500,000 sq.ft. office/processing facility.

PA Department of Environmental Protection Regional Headquarters (1997-2000)
Performed parametric DOE-2 simulations and ASHRAE 90.1 energy analysis; Conducted post-occupancy calibration of simulation model for energy analysis of system operation.

BMG Direct Office and Call Center (1996-1997)
Conducted occupancy surveys on user comfort and satisfaction in 400-person call center; Performed field measurements of temperature, humidity, air flow, illuminance, CO2.

Buildings Systems Research

The Building as Power Plant (1998-2000)
Developed and used Energy Self-Sustenance indices to assess effectiveness of Combined Heat and Power systems for different building configurations and climatic contexts.

The Robert L. Preger Intelligent Workplace Laboratory (1991 - 1998)
Worked with design team on development of enclosure and HVAC systems for unique "Office of the Future" demonstration project; Performed DOE-2 energy simulations for energy and daylighting analysis; Conducted monitoring and evaluation of indoor thermal environment.

Sage Electrochromic Glazing (1999-2000)
Developed alternative enclosure configurations and control strategies for electrochromic glazing; Performed parametric energy simulations to evaluate alternatives.

Impact of Lighting and HVAC Zoning Strategies in Commercial Buildings (1994-1996)
Joint Project with National Research Council, Canada; Assessed energy impact of user-based zoning and control strategies for HVAC and lighting systems in commercial buildings.

Simulation Tools Development

The S2 Project (1997-2000)
Worked with team on design and development of Java-based software tool for building design and performance simulation (S2); Integrated NODEM energy analysis tool with S2, to provide energy analysis on the internet.

NODEM: Integrated Design and Energy Simulation (1993 - 1997)
Ph.D. Thesis; Developed and implemented a nodal heat-balance based energy simulation tool (NODEM) in C++; Validated NODEM against other detailed simulation tools using DoE BESTEST protocol.

Publications

Journal Papers

Mahdavi, A., P. Mathew, S. Kumar, and N.H. Wong "Bi-directional Computational Design Support in the SEMPER Environment". *Automation in Construction*, pp. 353-373, 1997.

Mahdavi, A., R. Brahme, P. Mathew. "The 'LEK'-Concept and its Applicability for the Energy Analysis of Commercial Buildings," *Building and Environment*, Vol. 31, No. 5, pp. 409-415, Great Britain, 1996.

Mahdavi, A., S. Kumar, P. Mathew, V. Hartkopf, V. Loftness. "Effects of Lighting, Zoning, and Control Strategies on Energy Use in Commercial Buildings". *Journal of the Illuminating Engineering Society*. Volume 24, Number 1, Winter 1995. pp. 25 - 35.

Mahdavi, A., L. Berberidou-Kallivoka, P. Mathew, and K.J. Tu. "Predication of Daylight Factors in "Realistic" Settings: A Demonstrative Case Study". *Journal of the Illuminating Engineering Society*. 22 (Number 1, Winter 1993): 40-44A.

Mahdavi, A., T. Jeung, and P. Mathew. "Conductive Heat Transfer Through Insulated Building Enclosure Components: A Cross-Sectional Analysis of Constructions Typical to Low-Rise Residential and Commercial Buildings in North America". *Journal of Thermal Insulation and Building Envelopes.* 16 (October 1992): 161-182.

Conference Papers

Mathew, P., D. Sartor, W. Lintner, P. Wirdzek. "Labs21 Environmental Performance Criteria: Toward LEED for Labs", *The Austin Papers*, Best of the 2002 International Green Building Conference, Building Green, Brattleboro, VT.

Mathew, P., V. Hartkopf, A. Mahdavi. "Towards the Building as Power Plant: Computational Analysis of Energy Self-Sustenance," *Building Simulation '99*, Kyoto, Japan. International Building Performance Simulation Association.

Mathew, P., A. Mahdavi "High Resolution Thermal Modeling for Computational Building Design Assistance" *Computing In Civil Engineering; Proceedings of the International Computing Congress, 1998 ASCE Annual Convention*. October 18-21, Boston, MA. PP. 522-533.

Loftness, V., V. Hartkopf, S. Lee, A. Mahdavi, P. Mathew, J. Shankavaram, A. Aziz. "The Collaborative Building: Mediating between Climate and Interior Quality", *Second International Workshop, CoBuild'99, Pittsburgh, PA, USA, October 1-2, 1999,* and published in *Lecture Notes in Computer Science No. 1670, Springer-Verlag, Heidelberg Germany,* pp. 29-44

Mahdavi, A., M. Ilal, P. Mathew, R. Ries, G. Suter. "Aspects of S2", *Computers in Building: Proceedings of the CAADfutures '99 Conference*, Atlanta, Georgia, June 7-8, 1999.

Loftness, V., V. Hartkopf, S. Lee, A. Mahdavi, P. Mathew, J. Shankavaram, A. Aziz. "Architectural Alternatives for IAQ and Energy Efficiency," *ASHRAE IAQ'98 Conference*, New Orleans, LA, October 24-27, 1998.

Hartkopf, V., H.W. Roth, J. Freihaut, V. Loftness, and P. Mathew, "Towards User-Centered and Sustainable Thermal Conditioning Strategies for Large Buildings," *International Symposium, Air Conditioning in High Rise Buildings '97*, Shanghai, PR. China, September 9-12, 1997.

Mahdavi, A., P. Mathew, K.P. Lam. "Aggregate Space-Time Performance Indicators for Simulation-based Building Evaluation Procedures," *IBPSA (International Building Performance Simulation Association) Conference*, Prague. Vol. II, pp. 293 - 298, 1997.

Mahdavi, A., P. Mathew, S. Kumar, N. Wong. "Passive Solar Design via Bi-directional Computational Inference," Proceedings of *The 22nd National Passive Solar Conference*. April 25-30 1997, Washington D.C. R. Campbell-Howe and B. Wilkins-Crowder (eds). American Solar Energy Society, American Institute of Architects. pp. 301-306, 1997.

Mahdavi, A., P. Mathew, N.H. Wong. "A Homology-based Mapping Approach to Concurrent Multi-domain Performance Evaluation," Proceedings of *The Second Conference on Computer Aided Architectural Design Research in Asia: CAADRIA '97* (Ed.: Yu-Tung Liu, Jin-Yen Tsou, June-Hao Hou). Hsinchu, Taiwan. pp. 237 - 246, 1997.

Loftness, V., V. Hartkopf, A. Mahdavi, S. Lee, J. Beckering, P. Mathew, J. Shankavaram, and K.J. Tu . "The Intelligent Workplace Retrofit: Investing in the Hidden Infrastructures for Workplace Flexibility and Performance," *IB/IC Conference*, Israel, March 1997.

Mahdavi, A., P. Mathew, R. Brahme, S. Kumar. "Implications of Intelligent HVAC Zoning Strategies for Thermal Comfort and Energy Use," *Proceedings of The 2nd International Congress on Intelligent Buildings*, Tel-Aviv, Israel, 1997.

Mahdavi, A., P. Mathew, R. Brahme, S. Kumar. "Implications of Individualized Thermal Conditioning for Comfort and Energy Use in Office Buildings", *2nd International Congress on Intelligent Buildings,* Tel Aviv, Israel, March 4-6, 1997.

Mahdavi A., P. Mathew, V. Hartkopf, V. Loftness "Bi-directional Inference in Thermal Design", *Proceedings of the Association for Computer Aided Design in Architecture (ACADIA) 1996 Conference*, Tucson, AZ, October 31-November 2, 1996, pp. 133-143.

Mahdavi, A, P. Mathew. "Implementation Strategies for Open Inference Design Environments." *Proceedings of the ITCSED-Conference*, Glasgow, 1996.

Mahdavi, A., P. Mathew, S. Lee, R. Brahme, S. Kumar, G. Liu, R. Ries, N-H Wong. "On the Structure and Elements of SEMPER," *Proceedings of the the Association for Computer Aided Design in Architecture (ACADIA) 1996 Conference*, Tucson, AZ, 1996, pp. 71-84.

Mahdavi, A. V., Loftness, P, Mathew, R., Brahme, S., Kumar, N. H., Wong. "Integrated Modeling of the Thermal Environment," *Proceedings of the 1996 International Symposium of CIB W67 (Energy and Mass Flows in the Life Cycle of Buildings).* Vienna, Austria, 1996, pp. 561-566.

Mahdavi, A., V. Hartkopf, P. Mathew. "The Potential for Improving the Energy Performance of HVAC, Lighting, and Enclosure Systems in Commercial Buildings." *Proceedings of Tsinghua-HVAC-'95: International Symposium on Heating, Ventilation, and Air Conditioning*, 1995.

Mahdavi, A., P. Mathew. "Synchronous Generation of Homologous Representations in an Active, Multi-Aspect Design Environment," *Proceedings of the Fourth International Conference of the International Building Performance Simulation Association (IBPSA),* ed. Mitchell, J.W., Beckman, W. A., Madison, Wisconsin , 1995, pp. 522 - 528.

Loftness, V., V. Hartkopf, A. Mahdavi, S. Lee, A. Aziz, P. Mathew. "Environmental Consciousness in the Intelligent Workplace," *NEOCON 1994*, Chicago, Illinois, June, 1994.

Mahdavi, A., P. Mathew, S. Kumar, V. Hartkopf, V. Loftness. "Effects of Lighting, Zoning, and Control Strategies on Energy Use in Commercial Buildings," *Proceedings of the 1994 Illumination Engineering Society of North America (IESNA) Annual Conference*, Miami, Florida, August 9-11, pp. 501-511, 1994.

Mahdavi, A., S. Lee, P. Mathew. "Heat Transfer Analysis of Complex Building Components: A Multi-aspect Study of Implications for Energy and Indoor Climate". *CLIMA 2000, Engineering the Built Environment*, London, England, 1993.

Mahdavi, A., P. Mathew. "Hygro-thermal Behavior of Building Components with regard to Their Impact on Energy Consumption and Indoor Climate," *Proceedings of CIB '92, World Building Congress*, Montreal, Canada, 1992, Volume 1, pp. 98-103, 1992.

Research & Consulting Reports

Hartkopf, V., J. Shankavaram, P. Mathew, V. Loftness, A. Aziz, R. Watson. *Beijing Energy Efficiency and Renewable Energy Demonstration Building*, Report from the U.S.-Chinese Energy and Environmental Building Design Workshop held at CMU, December 8-11, 1999.

Loftness, V., P. Mathew, et al. *Sustainable Development Alternatives for Speculative Office Buildings*, Research Report, Center for Building Performance and Diagnostics. 1999.

Mahdavi, A., P. Mathew. (1999): *Daylighting and Energy Analysis of PNC Bank Operations Center*, Research Report, Built Environment Research Laboratory, Center for Building Performance and Diagnostics.

Mathew, P., *Energy Analysis of the Armstrong Innovation Center*, Research Report, Built Environment Research Laboratory, Center for Building Performance and Diagnostics. 1999.

Newsham, G. R., A. Mahdavi, P. Mathew, S. Cornick, D.M. Sander, R. Brahme. *The Impact of the Adoption of Efficient Electrical Products and Control Technologies on Office Building Energy Use*. Institute for Research in Construction, National Research Council Canada, Ottawa, Canada, 1997.

Loftness, V., P. Mathew, G. Liu, J. Shankavaram, and K.J. Tu, *Workspace Evaluation of BMG Direct Customer Service Departments* (Phase 1: Old Facility). Performed for Steelcase, Inc., Grand Rapids, Michigan by Center for Building Performance and Diagnostics, Department of Architecture, Carnegie Mellon University, Pittsburgh, Pennsylvania, August 1996.

Mahdavi, A., S. Lee, R. Brahme, S. Kumar, P. Mathew, and V. Pal. *Computational Evaluation of Five Energy Simulation Programs in View of Residential Applications*. Report for the Susquehanna Project, Center for Building Performance and Diagnostics, Carnegie Mellon University, Pittsburgh, PA, May 23, 1996.

Loftness, V., V. Hartkopf, A. Mahdavi, S. Lee, J. Shankavaram, K.J. Tu, A. Aziz, and P. Mathew. *Flexible Grid - Flexible Density - Flexible Closure Officing: The Intelligent Workplace* U.S. Army Construction Engineering Laboratories (USACERL). Contract DACA 88-93-D-0004 - Phase 1, January 1995.

Mahdavi, A., P. Mathew, S. Kumar, V. Hartkopf, V. Loftness. *Parametric Simulation Studies on the Implications of Zoning, Lighting, and Enclosure Options on Energy Requirements in Office Buildings*. EPRI. 1994.

Lee, S., and P. Mathew. *Design Guidelines for the Advanced Technology Urban Townhome Prototype*. Pennsylvania Advanced Technology Housing Consortium (PATHC) Project, 1990.

Presentations and Workshops

Labs21 Annual Technical Conference
Technical presentations, moderator of plenary session

Labs21 Introductory Design Course
Presenter for sessions on architecture, lighting, green rating systems

DOE Commercial Buildings Roadmap
Participant in multiple workshops to develop research agenda in commercial buildings

DOE Next Generation Simulation Tools Workshop
Participant in workshop to establish user needs and research agenda for simulation tools

Beijing Energy Efficiency Demonstration Project
Workshop with Chinese delegation; Facilitated sub-group on performance benchmarking

Workplace 2001, University of Wisconsin
Presentations on Intelligent Building systems

International Building Performance Simulation Association
Technical presentations on building simulation and integrated energy systems

American Solar Energy Society
Panelist for forum on natural conditioning strategies for commercial buildings

Awards

Power Player Award, Enron Energy Services
Awarded for developing business process and tools for scalable pricing of energy projects

Faculty Development Grant (1998)
Awarded seed-grant for research in building-integrated energy systems.

Graduate Teaching Award (1995)
Honorable mention for graduate course in energy simulation